This listing of claims will replace all prior versions, and listings, of claims in the application.

LISTING OF CLAIMS:

Claim 1 (currently amended): An arrayed in-line optical device, comprising:

a first optical fiber collimator array, including:

a first optical fiber array block configured to receive and retain a first plurality of individual optical fibers which carry optical signals, the first optical fiber array block including a first block surface; and

a first microlens array substrate coupled to the first optical fiber array block, the first microlens array substrate including a first plurality of microlenses formed on the substrate and integrated along a first microlens surface and a first substrate surface opposite the first microlens surface, wherein the optical signals from the first plurality of individual optical fibers are each collimated by a different one of the first plurality of integrated microlenses;

a second optical fiber collimator array, including:

a second optical fiber array block configured to receive and retain a second plurality of individual optical fibers which carry the optical signals, the second optical fiber array block including a second block surface; and

a second microlens array substrate coupled to the second optical fiber array block, the second microlens array

substrate including a second plurality of microlenses formed on the substrate and integrated along a second microlens surface and a second substrate surface opposite the second microlens surface, wherein the optical signals provided to the second plurality of individual optical fibers are each provided by a different one of the second plurality of integrated microlenses; and

an optical chip coupled between the first and second microlens surfaces, array ~~substrate and the second microlens array subst~~rate, the optical chip including a first chip surface and a second chip surface,

wherein the first block surface is coupled to the first substrate surface and the second block surface is coupled to the second substrate surface by an index-matched optical adhesive,

wherein the first and second block surfaces are angled and the first and second substrate surfaces are sloped at an angle in the range of about 4 to 12 degrees from perpendicular to the optical axes of the first and second plurality of individual optical fibers, respectively,

wherein the pitch of the first and second plurality of integrated microlenses is within a range of about 125 to 2500 microns,

wherein lens axes of the first and second plurality of integrated microlenses are tilted to the optical axis that passes through the first and second plurality of integrated microlenses at an angle in the range of about 0.1 to 5 degrees, and

wherein the optical chip is inclined against the optical axis and the first and second chip surfaces are at an angle in the range of about 0.1 to 5 degrees from perpendicular to the optical axis of the optical powers that pass through the optical chip.

Claims 2-80: Canceled.

Please add new claims 81 94 as follows:

Claim 81 (New): The arrayed optical device of claim 1, wherein an optical index of the adhesive between the first block surface and the first substrate surface matches that of one of the core of the first plurality of individual optical fibers and first substrate surface, the other of the first block surface and the first substrate surface including an anti-reflection (AR) coating for index matching to the adhesive, and

wherein an optical index of the adhesive between the second block surface and the second substrate surface matches that of one of the core of the second plurality of individual optical fibers and the second substrate surface, and the other one of the second block surface and the second substrate surface includes an anti-reflection (AR) coating for index-matching to the adhesive.

Claim 82 (New): The arrayed optical device of claim 1, wherein the first and second plurality of microlenses are graded

index (GRIN) lenses, wherein the first microlens surface is coupled to the first chip surface by an optical adhesive index-matching to one of the first microlens surface and the first chip surface, and the other of the first microlens surface and the first chip surface includes an anti-reflective (AR) coating for index-matching to the adhesive, and

wherein the second microlens surface is coupled to the second chip surface by an optical adhesive index-matching to one of the second microlens surface and the second chip surface, and the other of the second microlens surface and the second chip surface includes an anti-reflection (AR) coating for index-matching to the adhesive.

Claim 83 (New): The arrayed optical device of claim 1, further including:

a first spacer, the first spacer coupling the first optical fiber array block to the first microlens array substrate;

a second spacer, the second spacer coupling the second optical fiber array block to the second microlens array substrate;

a chip spacer configured to retain the optical chip and provide an air gap between the first chip surface and the first plurality of mocrolenses and another air gap between the second chip surface and the second plurality of microlenses,

wherein the first spacer includes a first hole such that the optical signals provided by the first plurality of

individual optical fibers pass through air before encountering the first microlens array substrate,

wherein the second spacer includes a second hole such that the optical signals provided by the second plurality of individual optical fibers pass through air before encountering the second microlens array substrate, and

wherein the first and second block surfaces, the first and second substrate surfaces, the first and second microlens surfaces and the first and second chip surfaces include anti-reflection (AR) coatings.

Claim 84 (New): The arrayed optical device of claim 1, wherein the optical chip includes at least one of an optical isolator chip, an optical circulator chip, a gain flattening filter, a thin film filter, a variable optical attenuator, a polarization beam splitter, a wavelength plate, a prism, a grating, a mirror, a dynamically adjustable active optical material and polarizing material.

Claim 85 (New): An arrayed in-line optical device, comprising:

a first optical fiber collimator array, including:

a first optical fiber array block configured to receive and retain a first plurality of individual optical fibers which carry optical signals, the first optical fiber array block including a first block surface;

a first spacer including a first front surface and a first back surface opposite the first front surface, wherein the first block surface is angled and the first front surface is slanted at a same angle in the range of about 4 to 12 degrees from perpendicular to the optical axis of the first plurality of individual optical fibers, and

wherein the first front surface is coupled to the first block surface by an index matched optical adhesive; and

a first microlens array substrate including a first plurality of microlenses integrally formed on the substrate and along a first microlens surface, and a first substrate surface opposite the first microlens surface, wherein the optical signals from the first plurality of individual optical fibers are each collimated by a different one of the first plurality of integrated microlenses,

wherein the first plurality of microlenses are graded index (GRIN) lenses, and an optical index of the first spacer is similar to that of the first plurality of microlenses,

wherein the first microlens surface is coupled to the first back surface by another index-matched optical adhesive,

wherein angles of the first back surface and the first microlens surface are less than 5 degrees from perpendicular to the optical axis of the optical powers that pass through the first microlens array substrate, and

wherein the first substrate surface is sloped at an angle in the range of about 0.1 to 10 degrees from perpendicular

to the optical axis of the optical powers that pass through the first microlens array substrate;

a second optical fiber collimator array, including:

a second optical fiber array block configured to receive and retain a second plurality of individual optical fibers which carry the optical signals, the second optical fiber array block including a second block surface;

a second spacer including a second front surface and a second back surface opposite the second front surface, wherein the second block surface is angled and the second front surface is slanted at a same angle in the range of about 4 to 10 degrees from perpendicular to the optical axis of the second plurality of individual optical fibers, and

wherein the second front surface is coupled to the second block surface by an index-matched optical adhesive; and

a second microlens array substrate including a second plurality of microlenses integrally formed on the substrate and along a second microlens surface, and a second substrate surface opposite the second microlens surface, wherein the optical signals provided to the second plurality of individual optical fibers are each provided by a different one of the second plurality of integrated microlenses,

wherein the second plurality of microlenses are graded index lenses (GRIN) and an index of the second spacer is similar to that of the second plurality of microlenses,

wherein the second microlens surface is coupled to the second back surface by another index-matched optical adhesive,

wherein angles of the second back surface and the second microlens surface are less than about 5 degrees from perpendicular to the optical axis of the optical powers that pass through the second microlens array substrate, and

wherein the second substrate surface is sloped at an angle in the range of about 0.1 to 10 degrees from perpendicular to the optical axis of the optical powers that pass through the second microlens array substrate; and

an optical chip coupled between the first and second substrate surfaces, the optical chip including a first chip surface and a second chip surface, wherein the first substrate surface is coupled to the first chip surface and the second substrate surface is coupled to the second chip surface,

wherein a pitch of the first and second plurality of integrated microlenses is within a range of about 125 to 2500 microns, and

wherein the optical chip is inclined against the optical axis and the first and second chip surfaces are at an angle in the range of about 0.1 to 10 degrees from perpendicular to the optical axis of the optical powers that pass through the optical chip.

Claim 86 (New): The arrayed optical device of claim 85, wherein an optical index of the adhesive between the first block

surface and the first front surface matches that of one of the core of the first plurality of individual optical fibers and the first spacer, and the other of the first block surface and the first front surface includes an anti-reflection (AR) coating for index-matching to the adhesive, and wherein an optical index of the adhesive between the second block surface and the second front surface matches that of one of the core of the second plurality of individual optical fibers and the second spacer, and the other of the second block surface and the second front surface includes an anti-reflection (AR) coating for index-matching to the adhesive.

Claim 87 (New): The arrayed optical device of claim 85, wherein the first substrate surface is coupled to the first chip surface by an optical adhesive index-matching to one of the first substrate surface and the first chip surface, and another one of the first chip surface and the first substrate surface includes an anti-reflection (AR) coating for index-matching to the adhesive, and wherein the second substrate surface is coupled to the second chip surface by an optical adhesive index matching to one of the second substrate surface and the second chip surface, and another one of the second chip surface and the second substrate surface includes an anti-reflection (AR) coating for index-matching to the adhesive.

Claim 88 (New): The arrayed optical device of claim 85, wherein the optical chip includes at least one of an optical isolator chip, an optical circulator chip, a gain flattening filter, a thin film filter, a variable optical attenuator, a polarization beam splitter, a wavelength plate, a prism, a grating, a mirror, a dynamically adjustable active optical material and polarizing material.

Claim 89 (New): An arrayed in-line optical device, comprising:

a first optical fiber collimator array, including:

a first optical fiber array block configured to receive and retain a first plurality of individual optical fibers which carry optical signals, the first optical fiber array block including a first block surface;

a first spacer including a first front surface and a first back surface opposite the first front surface, wherein the first front surface is coupled to the first block surface, and

wherein the first block surface is angled and the first front surface is slanted at a same angle in the range of about 4 to 12 degrees from perpendicular to the optical axis of the first plurality of individual optical fibers; and

a first microlens array substrate including a first plurality of microlenses integrally formed on the substrate and along a first microlens surface, and a first substrate surface

opposite the first microlens surface, wherein the optical signals from the first plurality of individual optical fibers are each collimated by a different one of the first plurality of integrated microlenses,

wherein the first microlens surface including anti-reflection (AR) coating is coupled to the first back surface,

wherein the first spacer includes a first hole such that the optical signals provided by the first plurality of individual optical fibers pass only through air before encountering one of the first plurality of microlenses,

wherein angles of the first back surface and the first microlens surface are less than about 5 degrees from perpendicular to the optical axis of the optical powers that pass through the first microlens array substrate, and

wherein the first substrate surface is sloped at an angle in the range of about 0.1 to 10 degrees from perpendicular to the optical axis of the optical powers that pass through the first microlens array substrate;

a second optical fiber collimator array, including:

a second optical fiber array block configured to receive and retain a second plurality of individual optical fibers which carry the optical signals, the second optical fiber array block including a second block surface;

a second spacer including a second front surface and a second back surface opposite the second front surface,

wherein the second front surface is coupled to the second block surface, and

wherein the second block surface is angled and the second front surface is slanted at a same angle in the range of about 4 to 12 degrees from perpendicular to the optical axis of the second plurality of individual optical fibers; and

a second microlens array substrate including a second plurality of microlenses integrally formed on the substrate and along a second microlens surface, and a second substrate surface opposite the second microlens surface, wherein the optical signals provided to the second plurality of individual optical fibers are each provided by a different one of the second plurality of integrated microlenses,

wherein the second microlens surface including anti-reflection (AR) coating is coupled to the second back surface,

wherein the second spacer includes a second hole such that the optical signals provided to the second plurality of individual optical fibers pass only through air after encountering one of the second plurality of microlenses,

wherein angles of the second back surface and the second microlens surface are less than about 5 degrees from perpendicular to the optical axis of the optical powers that pass through the second microlens array substrate, and

wherein the second substrate surface is sloped at an angle in the range of about 0.1 to 10 degrees from perpendicular to

the optical axis of the optical powers that pass through the second microlens array substrate; and

an optical chip coupled between the first and second substrate surface, the optical chip including a first chip surface and a second chip surface, wherein the first substrate surface is coupled to the first chip surface and the second substrate surface is coupled to the second chip surface,

wherein the optical chip is inclined against the optical axis and the first and second chip surfaces are at an angle in the range of 0.1 to 10 degrees from perpendicular to the optical axis of the optical powers that pass through the optical chip,

wherein a pitch of the first and second plurality of integrated microlenses is within a range of about 125 to 2500 microns, and

wherein the first and second block surfaces include anti-reflection (AR) coating.

Claim 90 (New): The arrayed optical device of claim 89, wherein the first and second plurality of microlenses are reflective lenses, and wherein the first and second back surfaces and the first and second microlens surfaces are perpendicular to the optical axis of the optical powers that pass through the first and second microlens array substrates, respectively.

Claim 91 (New): The arrayed optical device of claim 89, wherein the first and second plurality of integrated microlenses are ones of graded index (GRIN) lenses or diffractive lenses and wherein the first and second back surface is slanted and the first and second microlens surface is tilted at a same angle in the range of about 0.1 to 5 degrees from perpendicular to the optical axis of the optical powers that pass through the first and second microlens array substrates, respectively.

Claim 92 (New): The arrayed optical device of claim 89, wherein the first substrate surface is coupled to the first chip surface by an optical adhesive index-matching to one of the first substrate surface and the first chip surface, and another one of the first chip surface and the first substrate surface includes an anti reflection (AR) coating for index-matching to the adhesive, and

wherein the second substrate surface is coupled to the second chip surface by an optical adhesive index-matching to one of the second substrate surface and the second chip surface, and another one of the second chip surface and the second substrate surface includes an anti-reflection (AR) coating for index-matching to the adhesive.

Claim 93 (New): The arrayed optical device of claim 89, further including;

a chip spacer configured to retain the optical chip and provide an air gap between the first chip surface and the first substrate surface and another air gap between the second chip surface and the second substrate surface, and

wherein the first and second substrate surfaces and the first and second chip surfaces include anti-reflection (AR) coatings.

Claim 94 (New): The arrayed optical device of claim 89, wherein the optical chip includes at least one of an optical isolator chip, an optical circulator chip, a gain flattening filter, a thin film filter, a variable optical attenuator, a polarization beam splitter, a wavelength plate, a prism, a grating, a mirror, a dynamically adjustable active optical material and polarizing material.